

THURSDAY, JANUARY 3, 1907.

PLANT DISPERSAL AND KINDRED PROBLEMS.

Observations of a Naturalist in the Pacific between 1896 and 1899. By H. B. Guppy. Vol. ii. Plant Dispersal. Pp. xxvi+627. (London: Macmillan and Co., Ltd., 1906.) Price 21s. net.

FEW of the problems that confront the naturalist are wider in their range of interest than those connected with the origin of the present inhabitants of an oceanic island. Such a population is almost always a very mixed one, though it can usually be roughly divided into two classes, the one embracing the aboriginal or endemic element, whilst the other is composed of colonists hailing, it may be, from widely-sundered centres of emigration. But closer investigation shows that such a distinction is, after all, not a very profound one. The forbears of the endemic groups were themselves at one time colonists; time and circumstance have permitted and encouraged divergent variation, and so new types have arisen. The causes responsible for the variation itself for the most part elude recognition, and their study is the business of the physiologist rather than of the naturalist, but the effects may well serve to concentrate the attention of the latter on the larger problems bearing on the nature and significance of adaptation no less than on those more directly concerned with the sources and mode of dispersal of the individual species.

Mr. Guppy, in his "Observations of a Naturalist in the Pacific," has kept both sets of problems clearly before him, and has produced a book that will deservedly appeal to a wide circle of biologists, and, indeed, to all who are interested, not merely in the details, but also in the philosophical aspects of distribution.

The author will probably not expect his ideas to command universal assent. It is inevitable, and indeed desirable, that divergence of opinion should exist as to the true explanation of phenomena which are still but imperfectly comprehended. But such dissentience in no way detracts from the value of his work. Perhaps the highest praise that can be earned by any contribution to science is to say of it that its facts are really facts, and its theories, whatever be their ultimate fate, are stimulants to further research.

Although the book before us deals with matters affecting the distribution of plants in general, the subject is more especially considered in relation to the littoral floras of the Pacific islands. The author takes as types to illustrate the wider bearings of his own observations the floras of Hawaii, Tahiti, and Fiji. He discusses very fully the various causes which in the case of the three island groups chosen have produced results so dissimilar, notwithstanding the equality of conditions which at first sight appears to prevail between them.

The keynote of the explanation advanced to account for the facts is to be found in the buoyancy of the

seed or fruit. But whilst many of the author's conclusions are both suggestive and interesting, it may be doubted whether others will be prepared to accept his views as to the connection between buoyancy and habitat.

Put briefly, his position is this. The capacity of floating determines the position of those species possessing buoyant fruits or seeds by the river or on the coast. Which of the latter stations is actually occupied will depend on the degree of transpiratory activity on the part of the plant, that is to say, on whether it happens to be a xerophyte or not. If the former, then it will be chiefly restricted to the coast, but if not it will be precluded from occupying a position that is only suited to plants that can withstand physiological drought, and it will be driven to take up its position by the river or pond. Mr. Guppy expressly and repeatedly states his conviction that it is not the station which is responsible for the development of buoyant seeds, but that the plants so characterised reach and colonise littoral or riparian stations because they can be distributed to them; in other words, position does not determine buoyancy, but buoyancy determines the station, subject to the further sorting-out process which is associated with xerophilous or hygrophilous habit.

But the author himself shows that seeds or fruits of the same species may exhibit great variation in their power of floatation, some sinking at once when placed in sea water, whilst others from the same tree may float without injury for months. He goes farther than this, and emphasises the need, in making such tests, of taking seeds from plants grown under similar conditions. Thus in *Azalia bijuga*, experiment showed that of the seeds taken from a littoral example 70 per cent. floated in sea water, whilst of those gathered from an inland individual of the same species only 23 per cent. were able to swim. Several other similar examples could be cited. Such evidence would seem, however, to indicate that the environment is not without its direct influence in determining the floatability or the reverse of the seeds, and clearly if this is so natural selection has material enough to work on. At any rate, one would hesitate before accepting the author's conclusions as to the real relation between buoyancy and station.

A very useful account is given of the several structural features to which buoyancy may be due. As they are often remarkably simple, it seems not unreasonable to think that an experimental study of the direct reaction of the plant to the environment in such cases as these would almost certainly yield interesting and valuable results.

The author has some excellent remarks on the nature and origin of adaptive characters, and they deserve to be carefully read by members of that large but somewhat careless class of naturalists who imagine that when a structure has been shown to be useful for a particular purpose, its occurrence is thereby "explained." Nothing can be farther from the truth, and the more we know of "adaptive" structures the less directly does their origin appear to be related with the function they ultimately dis-

charge. One might go so far as to suggest that it is only by accident that a character developed at one period in the life-history becomes of use at another, for such utility almost always involves a change of primitive function that could not have been foreseen at the first appearance of the structure in question. Thus to quote the case of the floating mechanism, the stimulus that provokes the formation of air-filled spaces is most often connected with respiration, and they are first "adapted" for this purpose. Their subsequent use for floatation is an accident. It is true it may be of immense importance to the *species*, but its value could not, so to say, have been foreseen by the individual in which it arises.

A chapter on mangroves forms an interesting diversion from the main track of the thesis. It is known that curious barren forms of the genus *Rhizophora* occur in various regions. These apparently combine the characters of more than one species, but the suggestion is put forward that they are not hybrids, but represent examples of dimorphism. The hypothesis is rather startling, but it is very well worth while testing. If it should prove to be well-founded, the investigation would certainly yield results of considerable scientific importance.

Limitations of space preclude the possibility of attempting to discuss the great bulk of new and interesting observations that crowd the pages of Mr. Guppy's book, but enough has been said to show that the author has made a very real contribution to biological science.

J. B. F.

PETROLEUM AND ITS PRODUCTS.

Petroleum and its Products. By Sir Boverton Redwood. Two vols. Pp. xxxii + 1064. Second edition, thoroughly revised and enlarged. (London: Charles Griffin and Co., Ltd.) Price 45s. net.

NO harder task exists than to criticise a book with which the reviewer is in complete accord, and so perfect an example of what a book of reference should be as Sir Boverton Redwood's monograph on petroleum and its products, of which the second edition has now been issued, offers no mark for criticism.

The ten years which have elapsed since the first edition of this work was published have seen many advances in the industrial use of petroleum products, and a period which has been marked by the growth of the use of liquid fuel from the experimental stage to the important position it now occupies in the principal navies of the world, and the perfection of the internal combustion engine with its widespread application, has brought in its wake so many alterations and modifications in processes that a complete revision, and indeed re-writing, of a very large portion of the book has been necessitated, the two volumes now containing more than a thousand pages.

The first section of the work deals with the history of the petroleum industry, from the use of bitumen in building the Tower of Babel down to statistics as recent as 1904, and this portion of the work is rendered the more valuable by the data being subdivided

under the headings of the various countries in which petroleum is found.

The geological and geographical distribution of petroleum and natural gas occupies the second section, which is illustrated by maps of the principal oil-bearing districts, and cross sections of some of the more important oil fields and wells. A consideration of the oil fields of the world naturally leads to the discussion of the chemical and physical properties of petroleum and natural gas, which occupies the third section of the work, and contains a wonderfully complete compilation of the enormous amount of work which has been done on the subject, and which is rendered the more valuable by the references being given for all the works quoted.

The next section deals with the much-vexed question of the origin of petroleum and natural gas, and a discussion of the various theories which have been from time to time formulated, and although the balance of evidence is distinctly in favour of the views expressed by Höfer and Engler, as to petroleum being of animal origin, whilst natural gas is a secondary product of the same decomposition, the reader cannot help the conviction that there are many cases in which a vegetable or even inorganic origin might have caused the deposits.

The fifth section will be considered by many readers one of the most important in the work, dealing as it does with the methods adopted for winning the crude oil, and much of the practical information as to the methods employed in the American, Canadian, Russian, and other oil fields is founded on the author's own experience.

The important subject of refining the oil, which occupies the next section, covers not only the general methods employed, but also the details of the methods of manufacture adopted in America, Russia, and elsewhere, and is enriched by numerous references and extracts from the work of Engler and other Continental authorities too little known in England.

The shale oil industry, being of British origin, claims a large amount of interest, and the struggles of James Young in founding it on its present basis form a fitting introduction to the seventh section, dealing with shale oil and allied industries, whilst an able section on the transport, storage, and distribution of petroleum ends the first volume of the book.

To the chemist the second volume is even more interesting than the first, as the reader is at once plunged into the methods adopted for the testing of crude petroleum and the many products obtained from it, and especially interesting is the historical account of the early legislation with regard to the flash point, and the part played by Sir Frederick Abel and the author in fixing the flash point at its present value. This section also contains a full account of the beautiful method of testing for petrol vapour and other inflammable vapours in air devised by Prof. Clowes and the author, which depends on the fact that a hydrogen flame of fixed dimensions burning in air containing a small proportion of inflammable gas or vapour is seen to be surmounted by a small cap or halo, the size of which indicates the amount of in-